DOCUMENT RESUME

ED 221 389 SE 039 201

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TITLE Capillary Suction Time. Operational Control Tests for Wastewater Treatment Facilities. Instructor's Manual [and] Student Workbook.
INSTITUTION Linn-Benton Community Coll., Albany, Oreg.
SPONS AGENCY Office of Water Program Operations (EPA), Cincinnati, Ohio. National Training and Operational Technology Center.
PUB DATE Apr 82
GRANT EPA-900953010
NOTE 22p.
AVAILABLE FROM Linn-Benton Community College, 6500 S.W. Pacific Blvd., Albany, OR 97321 ($1. student workbook, $2. instructor's guide).

EDRS PRICE MF01 Plus Postage. PC Not Available from EDRS.
DESCRIPTORS Instructional Materials; *Laboratory Procedures; Postsecondary Education; *Sludge; Teaching Guides; *Training Methods; *Waste Water; *Water Treatment
IDENTIFIERS Capillary Suction Time Test

ABSTRACT

Capillary suction time is time required for the liquid phase of a treated sludge to travel through 1 centimeter of media (blotter or filter paper). Designed for individuals who have completed National Pollutant Discharge Elimination System (NPDES) level 1 laboratory training skills, this module provides waste water treatment plant operators with the basic skills and information needed to: (1) run the capillary suction time test; (2) accurately record data and observations; (3) organize data to make required interpretations as to the general quality of the sludge utilized in the test; and (4) obtain reliable, consistent results from the test procedure. The instructor's manual contains a statement of instructional goals, lists of instructor/student activities and instructional materials, and student worksheet (with answers). The student workbook contains objectives, prerequisite skills needed before the module is started, laboratory procedures to determine capillary suction time, and worksheet. (Author/JN)

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ED221389

Operational Control Tests

for Wastewater Treatment Facilities

Capillary Suction Time

Instructor's Manual

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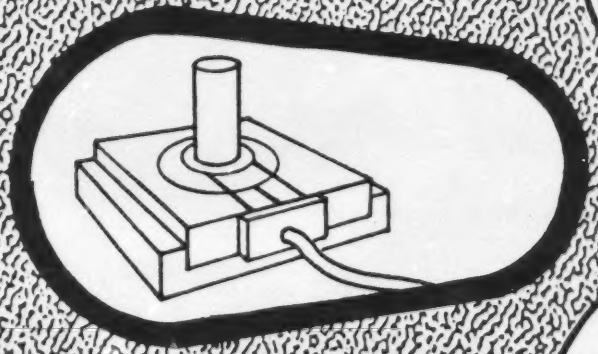

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SE 039 201

Linn-Benton Community College
Albany, Oregon

CAPILLARY SUCTION TIME (CST)

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Developed Under:
EPA Grant #900953010
August, 1981

CAPILLARY SUCTION TIME (CST)

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INSTRUCTIONAL GOALS

Upon completion of this lesson the student should be able to successfully run the capillary suction time (CST) test and accurately record the data and observations. The student should also be able to organize the data so as to make the required interpretations as to the general quality of the sludge utilized in the test.

INSTRUCTOR ACTIVITY

For best results follow this sequence:

	Activity	
1.	Review the procedural objectives with the students.	5 minutes
2.	Have the students read the procedure.	10 minutes
3.	Demonstrate the test procedure.	15 minutes
4.	Assign worksheet.	5 minutes
5.	Correct worksheet.	10 minutes
6.	Perform test.	30 minutes
7.	Make interpretations	10 minutes
8.	Relate CST to SR valves.	15 minutes

OHTER ACTIVITIES:

1. Using visuals clarify the process of establishing a correlation between CST and SR.
2. Have students predict SR from CST based on the above correlation.

STUDENT ACTIVITY

1. Read objectives.
2. Read procedure.
3. Complete worksheet.
4. Perform test.
5. Collect data.
6. Interpret results.

INSTRUCTIONAL MATERIAL LIST

1. Instructor's Guide - Capillary Suction Time
2. Student Workbook - Capillary Suction Time
3. Overhead projector with screen
4. Equipment listed in lab procedure

INSTRUCTIONAL GOALS

Upon completion of this lesson the student should be able to successfully run the capillary suction time (CST) test and accurately record the data and observations. The student should also be able to organize the data so as to make the required interpretations as to the general quality of the sludge utilized in the test.

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STUDENT ACTIVITY

1. Read objectives.
2. Read procedure.
3. Complete worksheet.
4. Perform test.
5. Collect data.
6. Interpret results.

5. For fast sludges use a _____ funnel.

a)_____ 1 cm

b)__X__ 1.8 cm

c)_____ either

d)_____ None of the above.

6. The sample funnel should be filled:

a)_____ 1/3 full.

b)_____ 1/2 full.

c)__X__ 2/3 full.

d)_____ 4/5 full.

e)_____ to the brim.

CAPILLARY SUCTION TIME

WORKSHEET

Directions: Place an "X" by the best answer. There is only one best answer for each question.

1. The major purpose for the capillary suction time test is to:
   a)_____ determine SVI.
   b)__X__ measure filterability of sludge.
   c)_____ determine decant time.
   d)_____ All of the above.
   e)_____ None of the above.

2. In general, it can be stated that a sludge that has the shortest time interval is the:
   a)_____ least dewaterable.
   b)__X__ most filterable.
   c)_____ one with highest solids content.
   d)_____ one with lowest solids content.
   e)_____ None of the above.

3. In some cases a double thickness of filter paper is used because:
   a)_____ the sludge is too thick.
   b)__X__ the time interval is too short.
   c)_____ the time interval is too long.
   d)_____ the SVI is too high.
   e)_____ MLSS is too high.

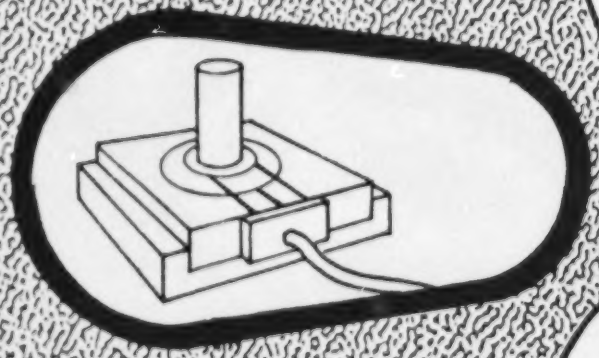
4. The clean-up procedure in this test is:
   a)_____ a rinse with alcohol.
   b)__X__ emptying the funnel, rinsing with soapy water and giving a final rinse with distilled water.
   c)_____ a rinse with distilled water only.
   d)_____ an acid rinse.
   e)_____ replacement of the funnel after each test.

Operational Control Tests

for Wastewater Treatment Facilities

Capillary Suction Time

Student Workbook



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CAPILLARY SUCTION TIME (CST)

CONTENTS

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INTRODUCTION

This instructional package on capillary suction time (CST) is intended to give the operator the basic information necessary to obtain reliable, consistent results from the test procedure. The mention of any brand names should not be taken as an endorsement of that material.

This instructional package is intended to be used by students who have completed the NPDES Level I laboratory skills training.

OBJECTIVES

Upon completion of this module you should be able to:

1. Describe the purpose of the capillary suction time test.
2. Describe the apparatus used in the test.
3. Describe the test procedure.
4. Perform the test procedure.
5. Interpret the quality of the sludge used in the test based on data obtained from the results.

PREREQUISITE SKILLS

In addition to the skills listed in the introduction the following skills are needed for this test:

1. Ability to use a timer clock.
2. Ability to plot data.

CAPILLARY SUCTION TIME TEST

INTRODUCTION

The capillary suction time is simply the time required for the liquid phase of a treated sludge to travel through 1 cm of media (blotter or filter paper). Capillary suction time (CST) can provide a close approximation to values found in the specific resistance test (SR) for a particular sludge. This test is preferable to the specific resistance test in that the complexity and duration of the specific resistance test is much greater.

Usefulness of this test can be enhanced by developing a correlation between capillary suction time values and specific resistance values for a given sludge. Once this correlation is established, it is a simple process to run the capillary suction time test and thus approximate specific resistance values for a sludge. Keep in mind, however, that a correlation must be established, therefore, a series of specific resistance tests must be run in conjunction to the CST.

EQUIPMENT

Capillary Suction Device

1 liter sample container

600 ml beaker

Filter paper (blotter paper)

PROCEDURE

1. COLLECT SAMPLE.

   Collect a sample of conditioned sludge in a 1 liter sample container. Leave space in the top to allow mixing.

2. TRANSFER SLUDGE.

   Transfer about 400 ml of well mixed sludge from the 1 liter container into a 600 ml beaker.

3. PLUG IN TEST HEAD.

   Plug the test head assembly into the test head socket.

4. CHECK PERSPEX BLOCKS.

   Insure that the two perspex blocks of the test head are clean and dry.

5. PLACE FILTER PAPER ON TEST HEAD.

   Place a filter paper on top of the perspex stand, and place the block having the stainless steel probes in it (probe side downward) on top of the filter paper.

6. SELECT FUNNEL.

   Select either the 1 cm diameter funnel for "fast" sludges or the 1.8 cm funnel for "slow" sludges.

7. INSERT FUNNEL.

   Insert the appropriate funnel into the test head. Rotate the funnel applying a light downward pressure when in position to insure even contact with the filter paper.

8. SWITCH ON APPARATUS.

9. PRESS RESET BUTTON.

   Press the reset button and note that the counter is at zero and that the reset lamp is lighted.

10. ADD SAMPLE.

    Pour the sludge sample into the funnel until it is about 2/3 full.

11. READ TIMER.

    As the liquid phase of the sludge moves through the filter paper it will activate a digital timer as one electrode is contacted by the liquid. The timer is shut off as the liquid contacts the second electrode. Elapsed time is read and recorded.

12. CLEAN-UP.

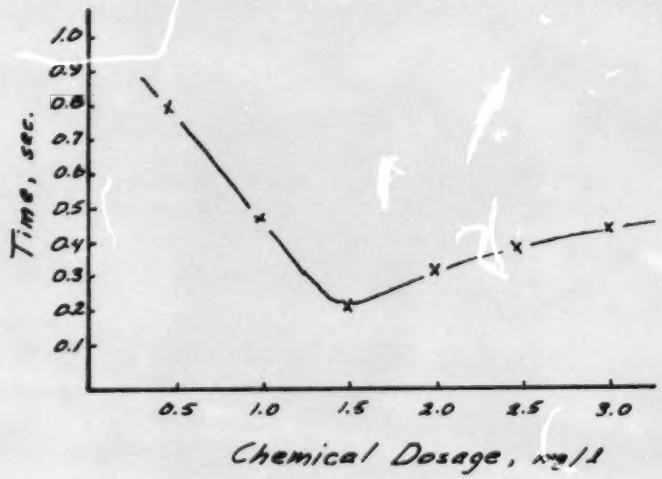
Empty the sample funnel and rinse with soapy water. Give a final rinse with distilled water.

* NOTE: A double thickness of filter paper may be used to slow down the rate of travel of the liquid. This is sometimes useful with very fast sludges.

INTERPRETATION

It generally can be stated that a sludge that dewaters (gives up its liquid) more rapidly is a more filterable sludge. Therefore, if the time interval read from the capillary suction apparatus is small the sludge is a superior sludge in terms of filterability. Longer time intervals indicate sludge that does not dewater as well.

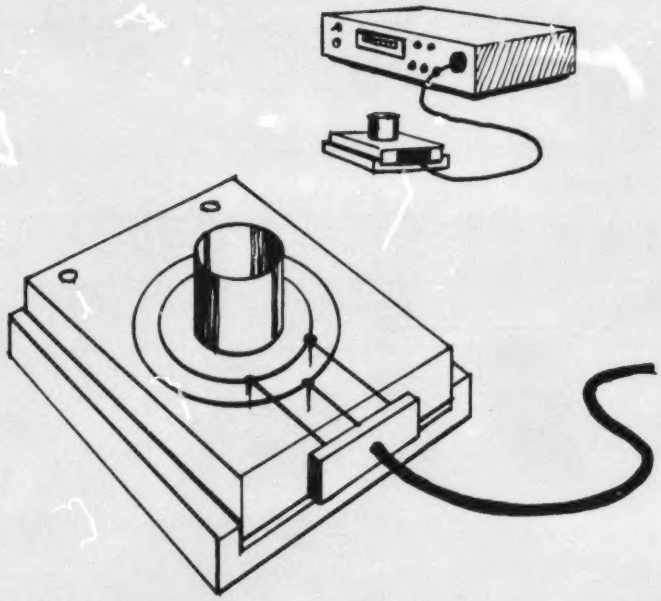
A sludge that has been dosed with varying concentrations of chemical conditioners can be evaluated by plotting time intervals against chemical concentrations as shown below.



The concentration that allows the shortest time interval is the dosage best suited to that particular sludge. Using CST values and correlating them against SR values the filterability of sludge can be estimated. Again, lower values mean more suitable sludges.

SUPPLEMENTARY MATERIALS

In order to establish a correlation between CST and SR the student must be able to conduct the SR test and to complete all calculations related to that test. See the SR test procedure.



CAPILLARY SUCTION TIME TEST APPARATUS

Capillary Suction Time Data (CST)

Lab Technician_____ Date _____ Shift_____

Sample Data				Chemicals Added, mg/l					CST, sec.
				1	2	3	4	5	
Sample No.	Sample Location	Sample Time	Collected By						

SAMPLE DATA SHEET

Capillary Suction Time Data (CST)

Lab Technician PC Date 9/4 Shift 3

Sample Data				Chemicals Added, mg/l					CST, sec.
				1	2	3	4	5	
Sample No.	Sample Location	Sample Time	Collected By	PAC A					
1	WSF	2:30 p	PC	0.5					1.2
2	"	"	"	1.0					1.0
3	"	"	"	1.5					0.7
4	"	"	"	2.0					0.5
5	"	"	"	2.5					0.8

NAME AND CONCENTRATION OF CHEMICALS

RECORD CST

SAMPLE IDENTIFICATION INFORMATION

PROCEDURE SUMMARY

PROCEDURE	CALCULATIONS
1. Collect sample.	None
2. Transfer 400 ml sludge to 600 ml beaker.	
3. Plug in test head.	
4. Check perspex blocks.	
5. Select funnel.	
7. Insert funnel.	
8. Switch on apparatus.	
9. Press reset button.	
10. Add sample.	
11. Read timer.	
12. Record data.	

Capillary Suction Time

The above procedure summary is designed as a laboratory aid. It may be cut out and attached to a 5" X 7" index card for convient reference at the laboratory bench. To protect the card you may wish to cover it, front and back, with clear, self-adhesive shelf paper or similar clear material.

CAPILLARY SUCTION TIME

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   d)_____ 4/5 full.

   e)_____ to the brim.